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PLANNING THE APPRENTICESHIP PROG

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Department of Education
Office of Vocational and Adult Education

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PLANNING THE APPRENTICESHIP PROGRAM

Instructor Training Module #2

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What Is This Booklet About?

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Words/Terms

1. *Analysis Coordinator* Individual responsible for coordinating the Analysis Committee
2. *Analysis Committee* Group responsible for conducting an occupational analysis
3. *Analysis Sheet* Forms used in the analysis of worker skills and knowledges
4. *Apprenticeable Occupation* An occupation for which apprenticeship training is suitable
5. *Apprenticeship Committee* Group responsible for administration of an apprenticeship program
6. *Goals* Statements of desired long-range program results
7. *Knowledges* What the job holder must understand in order to perform the job
8. *Motivation* That which prompts a person to act
9. *Objectives* Means for the achievement of goals
10. *Occupational Analysis* A systematic study of an occupation to obtain information needed to plan a program
11. *Plan* A formal document describing anticipated results and strategies for their achievement
12. *Planning* The determination of what results are to be accomplished and how to achieve them
13. *Psychomotor* Controlled physical/muscular behavior
14. *Sponsor* The organization that has final responsibility for an apprenticeship program
15. *Standards* Descriptions of apprenticeship program characteristics and procedures
16. *Strategy* A means or procedure for achieving results
17. *Technological Change* Changes in the basic way work is performed
18. *Work Activities* Those tasks required to be performed
19. *Work Processes* A classification of work activities

1. How To Use This Booklet

What Is The Series About?

Subjects instruction is an essential part of every apprenticeship program. It is the program component in which apprentices are taught the background and a range of applications of associated technical subjects such as mathematics, science and safety. Related instruction usually takes place in a classroom, after the work is over. Most frequently, related instruction is given by a skilled tradesperson or craftworker. For the apprentice to be an effective trainer, he or she must not only know their trade skills, but also they must have the teaching skills appropriate for conveying that knowledge to apprentices. This series of materials is designed to train related subjects instructors in the critical skills necessary to perform their jobs effectively. The titles of the booklets in the series are:

Introduction to Related Subjects Instruction and Service Training Materials
Planning the Apprenticeship Program
Planning Related Subjects Instruction
Developing Instructional Materials for Apprentices
Presenting Information to Apprentices
Selecting Learning Activities for Instruction
Providing for Individual Learner Needs
Controlling Instructional Settings
Evaluating Apprentice Performance
Communicating with Apprentices

The first booklet introduces the series, describes the content of each booklet, and provides an overview of the apprenticeship and of adult learners. The second booklet describes how to plan an apprenticeship program and may be used by related subjects instructors, sponsors or service agencies. The third of the other eight booklets deals with a set of skills judged by a panel of experts on apprenticeship to be critical to working effectively as a related subjects instructor.

What Is This Booklet About?

The materials in this booklet deal with planning the apprenticeship program. Planning is important because it

establishes the following skills required for the effective and efficient planning and organization of an apprenticeship program:

1. Conduct occupational analyses to determine needs for, support for, and general content of the program.
2. Establish apprenticeship program goals and objectives;
3. Incorporate ideas that facilitate upgrading of program to keep current with new technology, new training ideas and changes occurring in the occupation.

This booklet is targeted at an audience of would-be program sponsors, would-be service agency providers such as instructors and administrators in community colleges or technical institutes, and individuals who currently provide services in apprenticeship programs. This booklet does not deal with training skills as do the other booklets in this series.

What Must I Do To Complete My Work In This Booklet?

Working your way through this booklet will require you to read the text, to answer the questions, to perform the exercises, and to complete the pre- and post-assessment instruments. Expect to spend about five hours working through the materials. The only resources you need to complete your work in this booklet are: (1) a copy of the booklet; (2) a pencil or pen; (3) about two hours of time; and (4) recollection of past related instruction experience.

The materials are written in a self-instructional, programmed format. You may work through the text, examples and questions at your own pace and leisure; you need not complete your work in the booklet at one sitting.

Each chapter in the booklet is devoted to a single skill. The general format of the chapters is similar, with the following parts:

1. An *introduction* describing the skill and the instructional objectives for that skill.
2. *What is, when and why* to use the skill.
3. Step-by-step *directions* for how to perform the skill.

- Complete the self-assessment;
- Read and consider in detail the introduction and objectives for each skill;
- Read and study the text, examples and illustrations provided for each skill;
- Complete the self-test exercise for chapter and compare your answers with those provided in the appendix;
- If you complete the exercise as directed, continue your work in the booklet; if you fail to answer the questions correctly, repeat your work in the chapter under consideration; and
- At the conclusion of the booklet, complete the posttest for the unit. Check your answers against those provided. If you exceed the criteria, continue

How Much Do I Know About The Subject Before I Begin?

The self-assessment will assist you to identify competency areas associated with planning the program. Read each competency statement carefully, rate 1 and assess your level of knowledge about that skill in performing that task. Knowledge is what you know about the subject while skill is your experience in successfully performing that task. Circle the number that best describes your level of knowledge or skill. Competencies where your ratings are 1 or 2 are those that you should concentrate on. Pay special attention to the chapters which deal with those competencies.

Self-Assessment

Chapter in Booklet	Competency		Rating		
			Poor	Fair	Good Ex
Conduct operational analyses to determine need for support for general content of program.	1. Assess needs for apprenticeship training.	Knowledge Skill	1 1	2 2	3 3
	2. Develop support for apprenticeship programs.	Knowledge Skill	1 1	2 2	3 3
	3. Establish apprenticeship committee.	Knowledge Skill	1 1	2 2	3 3
	4. Analyze apprenticeable occupations and identify work activities and tasks.	Knowledge Skill	1 1	2 2	3 3
	5. Determine job skills, knowledges and motivation necessary for performing work activities.	Knowledge Skill	1 1	2 2	3 3
Establish standards and objectives for apprenticeship program	6. Set apprenticeship training standards.	Knowledge Skill	1 1	2 2	3 3
	7. Set apprenticeship administrative program standards.	Knowledge Skill	1 1	2 2	3 3
	8. Establish program goals/objectives.	Knowledge Skill	1 1	2 2	3 3
Incorporate standards that facilitate updating of program to keep current with new technology, training, ideas and changes occurring in occupations.	9. Update program periodically to include new technology, and/or training procedures.	Knowledge Skill	1 1	2 2	3 3

Determine Need For, Support For, And General Content Of The Program

Introduction And Objectives

The planning of an apprenticeship program must be based on a sound assessment of community need. A demonstrated need for skilled trade and craft persons is a powerful argument for an apprenticeship program and can be used to develop support by industry and labor leaders. Support for the idea of an apprenticeship program is absolutely essential since the success of the program is dependent upon a willingness of one or more sponsors to back the program.

Planning for an apprenticeship program requires a thorough understanding of the apprenticeable occupation. Based upon this understanding, job skills are identified and the knowledges and skills to be included in the apprenticeship program are determined. Thus, planning an apprenticeship program requires that a planner be able

1. Determine alternative means for assessing the local needs for apprenticeship training;
2. Identify possible ways of obtaining support for an apprenticeship program;
3. Suggest differing ways that an apprenticeship committee might be organized;
4. Identify the steps to be followed in conducting an occupational analysis;
5. Critique an occupational analysis to identify necessary job skills, knowledges and motivations;
6. Apply a technique to identify specific knowledges and motivations for a specified occupation.

As you begin to work through this unit of material, reflect back upon your apprenticeship experiences and knowledge. Draw upon these experiences as you consider how the ideas suggested in these materials could be incorporated into planning an apprenticeship program.

The What, Why, And When Of Apprenticeship Program Planning

Apprenticeship programs, like many other human activities,

is based upon a sound and thorough understanding of need for action and the alternative available choices. This information is provided by a technique called *occupational analysis*. Occupational analysis is the systematic study of an occupation to determine: (1) the need for skilled persons to perform that occupation and (2) the skills, knowledges and attitudes required to achieve mastery in that occupation.

Occupational analysis is a necessary first step in planning of an apprenticeship program. However, before conducting an occupational analysis, one must first determine whether the occupation in question is an apprenticeable occupation. Apprenticeable occupations generally are defined as those occupations for which: (a) skills are learned primarily through a combination of on-the-job training supplemented by related technical instruction; (b) require at least 2,000 hours of work experience plus related instruction; (c) involve manual, mechanical or technical skills and are practiced industry-wide as a recognizable trade or craft; (d) involve the development of a body of skills sufficiently well defined to be applicable throughout an industry and (e) do not primarily involve selling, managerial, clerical or professional activities.

Identification of a shortage of skills in an apprenticeable occupation can be used to develop support for offering an apprenticeship program. Since apprenticeable occupations represent a major component of industrial productivity, employers are quick to recognize the threat posed by a shortage of skilled craft/trade personnel. Labor organizations are likewise responsive to labor shortages since shortages signal a possibility of decreased membership. Just as shortages signal an increased need for apprenticeship, surpluses indicate a diminished enthusiasm for new apprenticeship programs. The upshot is that the argument for offering a new apprenticeship program should be grounded in a documented need for the employment of additional apprentices.

Given that a need for apprentices has been established, the next decision is who will sponsor the apprenticeship program. Apprenticeship programs may be sponsored by a single employer, a group of employers, or a combination

2. Skill: Conduct Occupational Analyses To Determine Need For, Support For, And General Content Of The Program

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- the extent to which that employment in a community is dominated by a single employer;
- the willingness of employers to assume training responsibilities;
- the extent of collective bargaining agreements; and
- the local community history regarding apprenticeship training.

Administration of the apprenticeship program is the responsibility of a local apprenticeship committee or a designated official in a particular company. When a committee is used, generally it consists of members representing the sponsoring organizations. If a labor organization is jointly sponsoring an apprenticeship program, the committee is termed a joint apprenticeship committee. Responsibility of apprenticeship committees of the director of apprenticeship includes selecting and indenturing apprentices, supervising training, establishing training curriculum, and certifying apprentices as journeymen upon completion of the program. Given these responsibilities, the role of the apprenticeship committee or director in the planning of an apprenticeship program is well established. The extent to which the committee or director plans the program, implements the plan and monitors the results will determine the extent to which the apprenticeship program operates as an efficient and effective training system for the development of skilled craft personnel.

Although most directly involved in the administration of apprenticeship programs, local apprenticeship committees and apprenticeship directors are not the only entities involved in an apprenticeship program. Other groups and organizations include the U.S. Department of Labor's Bureau of Apprenticeship and Training (BAT), the Federal Committee on Apprenticeship (FCA), the State and Territorial Apprenticeship Agencies (SAC) and the National Apprenticeship and Training Committees.*

Informed planning of an apprenticeship program requires detailed knowledge of the work processes, skills, knowledges, and motivation to perform as a skilled craft person. Provision of this information is the second major purpose of an occupational analysis.

Work activities, classified by major activity divisions of the trade, constitute the *work processes* that define the content of an apprenticeship training program. Work processes consist of major work categories and contain a series of activities under each category. *Activities* are general statements consisting of (1) an action verb and (2)

the object that is being acted upon. For example, a mobile mechanic is an apprenticeable occupation that may be divided into the following major work categories:

1. Lubrication;
2. Axles and Suspension;
3. Transmission and Clutch;
4. Brakes;
5. Motor Repair and Overhaul;
6. Carburetor;
7. Electrical System;
8. Cooling System;
9. Fuel System.

Activities under the major category of *Lubrication* include among other tasks: (a) fill or pack universal joints; (b) lubricate running gear; and (c) change oil and filters. The action verb — fill, pack, lubricate, change — indicates the work activity taking place. The object of the activity is universal joints with respect to fill or pack, running gear with respect to lubricate and oil and filters with respect to change.

Work processes provide a description of the major categories of work performed and a listing of component work activities for each major category. This work process describing the duties to be performed in an apprenticeable occupation provides a convenient organization for analyzing the job skills and knowledges required for successful performance in that occupation. *Job skills* are defined as statements of what the job holder must be able to do in terms of general areas such as: reading, writing, reasoning, listening, observation and analysis, abstract reasoning, problem-solving, interpersonal relationships and psychomotor skills.

Knowledges are statements of what the worker must understand in order to perform successfully on the job. The distinction between job skills and knowledges emphasizes the difference between what an apprentice must be able to do in terms of job behavior (job skill) and the knowledges required to enable the apprentice to perform that behavior. In apprenticeship training, this distinction separates on-the-job training where the apprentice learns by doing and related instruction where the apprentice acquires the necessary knowledge to provide meaningful support to those activities performed on the job.

How To Conduct An Occupational Analysis

Step 1: Assess The Need For Apprenticeship Training A Particular Trade Or Craft

Planning an apprenticeship program must be based on a clear demonstration of need. The most direct indicator of need is a shortage of skilled personnel in a particular craft or trade. The extent and severity of the shortage must be documented by hard data rather than speculation. A most direct way to collect such data is to survey employers about current and projected needs for craft or trade skills and the difficulties they are encountering or expect to encounter in hiring sufficient numbers of skilled personnel. Surveys may be conducted formally using a printed questionnaire or done more informally through telephone contact with a reasonable number of employers. Additional data on the demand for craft personnel in a local area can be obtained from the local office of the state employment security agency. Additional sources of information include associations of employers that logically would hire craft or trade members, appropriate union organizations, the State Apprenticeship Agency or the BAT state or district representative, and the National Joint Apprenticeship and Training Committee.

Data documenting existence of a shortage of craft/trade personnel is necessary but not sufficient to justify need for an apprenticeship program. To establish need, demonstrate either that no local training program exists that can meet the need or that there are strong reasons why an existing local program cannot be used. Thus, for a genuine need to exist, you must first prove that a shortage of craft/trade personnel exists and that this shortage cannot be resolved by any existing apprenticeship program.

Step 2: Build Support For An Apprentice Program

A base of support must be established before an apprenticeship program can be offered. One way to marshal support is to examine organizations in the local community that are most affected by a skills shortage. These organizations will be responsive to suggestions for reducing the shortage. If skills shortages impact more heavily on a large craft employer in a community, then it would make sense to seek support from that source. If, on the other hand, shortages are being experienced by several employers, then their collective support should be sought. It may be that a labor organization sees in a shortage an opportunity to augment its membership roles. In making the case, and assuming that no programs are

used. Arguments for offering an apprenticeship program include:

- Apprenticeship develops and insures a supply of trained workers and supervisors for their operation.
- Apprenticeship increases worker productivity, overall skills level and versatility;
- Apprenticeship minimizes the need for supervision of employees by developing initiative;
- Apprenticeship continues to attract capable men and women into the trade.

There are some negative points to consider. They include:

- Apprenticeship increases training costs resulting from required journeymen's time for providing instruction and supervision.
- There is a cost resulting from somewhat lower initial productivity of apprentices; however, a portion of that cost is offset by the lower wages paid to apprentices.
- There is no guarantee that the trained worker will stay with the company after completion of the apprenticeship period.

In order to convince an organization to sponsor an apprenticeship program, positive returns from adopting an apprenticeship program must be judged to outweigh negative costs. It is your responsibility as an apprentice advocate to convince potential sponsors that the benefits exceed the costs. Remember, apprenticeship is an investment in human capital that pays continuing dividends to the sponsor.

Step 3: Constitute An Apprenticeship Committee

A sponsor or co-sponsors should appoint their representatives to the Apprenticeship Committee. Employer representation should include the Director of Personnel, the Director of Training, depending upon who has major material responsibility for the training function. If the sponsor is a single employer, a craftsman and a craft supervisor should be represented on the committee. If a collective bargaining agreement is in effect, the language of the agreement generally will indicate the appropriate union representation. If a group of employers have agreed to sponsor the program, then each employer should be represented on the Apprenticeship Committee. In those cases where the number of employers is large, each

up at periodic intervals. The chairperson should have responsibility for the Committee agenda with the provision that any Committee member be allowed to place an item on the agenda for discussion.

Step 4: Determine Work Processes In A Chosen Trade/Craft

The purpose of this step is to describe the actual work activities that take place during the performance of the occupation. To insure that the description accurately portrays what takes place on the job, an analysis must be conducted by a group of persons intimately familiar with that occupation. Because of the central role of the Apprenticeship Committee in planning and administration of the program, the committee should prepare the description. If members of the Committee feel that they do not have a necessary familiarity with the occupation, they can point a stand-in representative. This situation might occur when the Personnel Director or Director of Training cannot be expected to have an operating knowledge of all apprenticeable occupations. In these cases, a craft supervisor should be appointed as a possible representative.

If the occupation has several specialties, these specialty areas should be represented. Perhaps additional crafts persons can be utilized in the capacity of consultants to the Apprenticeship Committee. In the case of group sponsorship, representatives should be selected that cover the range of occupational activities found across all employers in the group. This insures that persons familiar with all performance variations of the occupation will participate in the production of the occupational description. For purposes of reference, this group is termed the *Analysis Committee*.

Each member of the Analysis Committee should meet the following qualifications:

- Must have a demonstrated competence in the occupation;
- Must be employed or have been employed in the occupation;
- Must be able to work in a group;
- Must be able to verbalize the activities performed in the occupation;
- Must be committed to the importance of describing

job knowledge with work activities. Job knowledge is assumed to be supportive of the performed activities and are *not* to be equated with these activities. As a practical illustration of the difference, knowledge about bicycling and actually being able to ride a bicycle are different. One might be quite knowledgeable about the theories of bicycle balancing yet be unable to ride. Conversely, one may be able to ride a bicycle yet have no knowledge of the underlying physical principles that make it possible.

The Analysis Committee should meet in a well-lit, comfortable room that has a large uncluttered wall space. The task of the Committee is to generate, through spontaneous discussion, work activity statements that describe what a skilled craftsman must do. Each work activity statement is preceded by the statement "A journeyman must be able to . . ." (work activity statement). Each work activity statement consists of one or more action verbs and the object that is acted upon. For example, a typical work activity statement for a mechanic might be "adjust front wheel bearings"; "rebuild and repair differential centers"; or "re-face, re-seat and grind valves". In each case, the verbs describe what is done and the nouns indicate the objects acted upon. In most instances, eight to ten words will suffice to capture the action verbs and objects of the action.

These statements should describe the actual performance of journeymen. Avoid statements that indicate what should be known or understood since these are not observable directly. Prefacing each statement of activities with the phrase, "A journeyman must be able to . . ." maintains this behavior-knowledge distinction clearly and emphasizes the necessity to state work activities in observable terms.

As work activities are generated through Analysis Committee discussion, write these activity statements on three-by-five or four-by-six file cards. Letter the cards with a felt-tipped pen. Print letters large enough to be seen by every Committee member in the room. As cards are generated, attach them on the wall with plastic putty or some other adhesive. Preferably walls should be on the long dimension of the room and must be well lighted and free of any obstacles.

Divide the apprenticeable occupation into major divisions and sub-divisions. Major divisions are

Major categories of work for carpentry might include, for example:

1. flat work;
2. roughing and framing;
3. scaffold buildings;
4. building and setting concrete forms;
5. installation, erection and repair of fencing metals and woods;
6. layout;
7. roof framing, cornices and bay framing;
8. trim;
9. exterior covering; and
10. woodworking machines.

As a rule of thumb, the number of major occupational categories identified should not exceed ten to twelve.

Once a major category has been identified, write it on a card and affix it to the left end of the empty wall. Use the major occupational category to focus committee discussion and identify work activities falling under that major category. The task of the Committee is to brainstorm amongst themselves until they have come up with a satisfactory definition of the work activities making up that category. Write each activity on a card as it is defined. Post it to the right of the major category card in a horizontal line. Thus when complete, there will be a single *row of cards* that when considered together describe a major work category and its associated work activities. In most cases, ten to fifteen work activities are sufficient to exhaust the variety of activities performed. If more work activities are suggested, review them carefully so as to combine them with existing statements. If the Committee feels that significantly more work activities are required, this probably means that a major category was too broadly defined. Split this major category into smaller categories. In an opposite case, if the Committee is unable to come up with a significant number of work activities for a given major category. Combine the category with an existing category.

Repeat the process until all major categories and their associated work activities are defined to the satisfaction of the Committee. The product will be multiple rows of cards running horizontally across the wall. Each row will reflect a major category of the apprenticeable occupation.

The last task then remaining is to sequence the work activities within each major occupational divisional category. Sequencing should reflect the order in which the work activities must be learned. The Analysis Committee

committee members should then ask themselves: what activity should be learned first and in what order? The remaining activities should be learned. Order the horizontal row from left to right to reflect increasing levels of complexity. In a similar manner, sequence the tasks of every other remaining row in order of priority.

Each row should then be compared with the baseline row of cards. Do this by selecting a card from the comparison row to compare with the baseline. Compare the first card of the row, that is, the one at the farthest right end of the room, with the right most card of the baseline row. The work activity on the last card of the comparison row must be learned at the same time as the activity on the last card of the baseline row, then place the two cards side by side, each one on a card. If the last card on the baseline row was learned before the last work activity of the comparison row, place the card on the comparison row. Likewise, if the work activity on the last card of the comparison row must be learned before the last card of the baseline row, then place the card on the comparison row, to the left of the last card of the baseline row. Determine the exact place for each card by comparing it with the next-to-the-last card of the baseline row. If these two tasks can be learned simultaneously, then place the cards directly adjacent to each other. If not, compare the first card with some other card on the left on the baseline row until you find a card on the baseline row that contains an activity that must be learned at the same time. This will then establish the proper place for the comparison card.

Continue this activity until all cards are placed in proper order with the comparison row. The result is not only a sequence for the work activities within each row, but also a sequence for the activities across major work categories. This structure will help you in determining the order in which the activities should be learned.

The process of identifying work activities and sequencing them is a task for the Analysis Committee. The role of the coordinator is to make sure the process is mindful of its purpose and function. The coordinator encourages Committee members to focus on the attainment of these purposes and efforts on the attainment of these purposes. The coordinator's responsibility to provide orientation to the Committee and to assist the Committee in its task is to make sure the process is

misunderstanding of the process and too narrow a focus on the scope of work activities to be defined. The coordinator must be able to explain the mechanics of the process and to illustrate by example the level of detail required by the process.

Identification of the work activities is made easier by

tangible materials, objects, products or products with on the job. *People* refers to various relationships that are required in the conduct of the occupation in question. As an aid in selecting a number of these verbs are classified in Figure 1 to whether they refer to data, things or people.

Numerical/Written Material

abstracts	describes	looks up	refers to	tabulates
analyzes	detects	monitors	registers	transcribes
calculates	discovers	observes	reproduces	transfers
checks	edits	obtains	retrieves	transforms
classifies	estimates	prepares	reviews	translates
collects	evaluates	presents	routes	types
compiles	files	processes	scans	verifies
computes	gathers	produces	seeks	writes
considers	integrates	reads	solves	
copies	interprets	receives	stores	
counts	listens	records	summarizes	

Things

Materials/Objects/Events/Products/Procedures

abrades	creates	guards	organizes	sells
aligns	cuts	handles	packs	shapes
alters	decorates	hangs	paints	shaves
answers	delivers	holds	pastes	smooths
applies	demolishes	identifies	participates in	specifies
appraises	demonstrates	implements	places	splits
arranges	designs	initiates	planes	sorts
assembles	detects	inspects	plans	stores
assesses	develops	installs	plasters	tests
bakes	disperses	issues	pours	trims
balances	disconnects	judges	prepares	turns
bids	dispatches	keeps	presses	types
bores	draws	lays out	processes	unloads
builds	dresses	loads	produces	uses
burns	drills	locates	programs	washes
buys	engraves	maintains	protects	watches
calibrates	erects	makes	receives	weighs
carves	establishes	marks	recognizes	welds
casts	etches	measures	reconditions	
checks	evaluates	mills	refinishes	
chips	examines	miters	removes	
classifies	executes	mixes	repairs	
cleans	expedites	models	replaces	
codes	facilitates	mounts	reproduces	
compares	fastens	navigates	requisitions	
conducts	files	nets	routes	
connects	forms	notes	samples	
constructs	formulates	numbers	saws	
cooks	gives	observes	schedules	

Machines
Major pieces of machinery or equipment

sets up
operates
drives/controls
tends
maintains
repairs

People

Clients/Customers/Co-workers/Supervisors/Employees/Patients

advises	instructs
amuses	interviews
appraises	involves
assesses	leads
assigns	manages
assists	organizes
cares for	orients
communicates with	persuades
confers with	prepares
consults with	protects
controls	receives
coordinates	refers
councils	selects
directs	serves
disciplines	shows
discharges	speaks to
discusses with	stimulates
encourages	supervises
explains	talks to
grooms	teaches
guards	tests
guides	trains
hires	waits on
influences	

processes of the apprenticeable occupation. Work processes descriptions can be taken directly from the arrangement of cards produced in the preceding step. Before the cards are removed from the wall, give each row of cards an identification number. Assign each card within the row a letter of the alphabet starting with "a" on the left most card, "b" to second card on the left and so forth until all cards in the row have been assigned an alphabetic letter. Also assign each card the number of the row to which it is assigned. Thus, each card will have a number and a letter indicator on it. This enables you to restructure the cards, if you so desire.

Given the way the cards have been structured in the previous step, all work activities on cards with the same alphabetic letter can be learned at the same time. The learning order of all tasks can be established by ranking tasks according to their alphabetic designation. Those having earlier letters in the alphabet must be learned prior to those with later letters in the alphabet.

By coding each work activity with a number designating the major activity to which it belongs and a letter indicating the learning order, the work processes description of the apprenticeable occupation can be established according to the following format:

1. Title of the major work activity represented by row one;
 - a. Work activity on the card bearing the code 1a;
 - b. Work activity on the card bearing the code 1b
2. Title of the major work activity represented by row two;
 - a. Title of the work activity on the card coded 2a;
 - b. Title of the work activity on the card coded 2b
3. Title of the major work activity represented by the last row where N equals the total number of work activities considered.

The preceding format will provide an ordered description of the major divisions of the apprenticeable occupations and the work activities comprising each occupational division. Because of the nature of the process used to generate the work activities, each work activity represents a statement of observable behavior on the part of the apprentice. Analysis Committee members were instructed specifically to separate job behaviors from knowledges and understandings necessary to produce these behaviors. Therefore the purpose of this step is to concentrate on identifying skills and knowledges that support the work activities. As in previous steps, identification of skills and knowledges can best be undertaken through application of a systematic procedure.

Recall that the Analysis Committee members were instructed to consider the occupation in terms of its *things*, and *people* requirements. Use the same categories as a basis for analyzing the occupational requirements to determine what skills and knowledges an apprentice must have in order to perform the identified work activities. Prepare a separate skills-knowledge analysis sheet for each of the three areas. Divide the *things* dimension into subdivisions of (a) tools used, (b) materials, parts or fixtures used, and (c) machinery or equipment used.

Analysis sheets are shown in Figures 3-7. Note that all of the skills-knowledge analysis sheets follow the same basic format. Each begins by listing the major types and kinds of data, things or people dealt with. Be careful to provide an appropriate level of detail. It serves no major purpose to list every single tool or materials used on the job because this results in unnecessary detail. On the other hand, too broad a classification runs the risk of missing major types of tools, materials and equipment that may have specialized knowledge requirements. The intent is to define as major categories only those areas of data, things and people that have materially different knowledge requirements. As in the classification of general areas, the ultimate level of specification of detail is left to the discretion of the final users.

including tools such as technical manuals; instruction sheets; purchase orders; shipping invoices; work orders; and read-outs from dials, gauges or other test/measurement instruments.

B. Apprentice Must Be Able To: (Check all that apply)

- ☐ Recall factual information
- ☐ Interpret tables, charts or figures
- ☐ Locate required data in technical reference sources
- ☐ Interpret and follow a variety of technical instructions represented in mathematical or graphical form
- ☐ Keep records according to a prescribed standard of recordkeeping
- ☐ Record and/or compile observed data in written or tabular form
- ☐ Examine and determine values of data after using specialized measurement techniques
- ☐ Compute basic measurements (e.g., dimensions, tolerances, spacing, location, angles, diameter, area, rates)
- ☐ Solve algebraic equations
- ☐ Input and retrieve data from computer-controlled systems

C. Apprentice Must Know (Check all that apply)

- ☐ How to read and follow technical instructions
- ☐ How to use tables, charts and figures
- ☐ How to read blueprints, schematic drawings or orthographics
- ☐ How to read information from dials, gauges, meters or other such devices
- ☐ Procedures for locating and using technical reference documents

- ☐ Basic terms, symbols, and definitions used in the occupation
- ☐ Procedures and practices requiring orders/requisition/forms/routing of such documents
- ☐ How to maintain work records in prescribed format
- ☐ How to prepare work performance reports
- ☐ How to write letters/memos/reports
- ☐ How to compare whole numbers, integers, fractions, mixed numbers
- ☐ How to convert decimals to fractions, mixed numbers, proportions to percentages
- ☐ How to add, subtract, multiply, divide whole numbers, decimal numbers, fractions, mixed numbers, denominational numbers and/or percentages
- ☐ How to measure distances, angles, areas, perimeters, circumferences, areas of change
- ☐ How to solve algebraic equations with more unknowns

D. Based on the worker knowledge/skills, please provide a description of the knowledge/skills required for each area checked

A. List all major types of tools used:

D. Based on the worker knowledges checked, please provide a description of the specific edges required for each area checked.

B. Apprentice Must Be Able To: (Check all that apply)

- ☐ Select appropriate tool(s) for task at hand
- ☐ Make necessary set up or adjustments required to prepare and use the tool(s)
- ☐ Use tool(s) in a safe and proper manner
- ☐ Provide for routine care and maintenance of tools

C. Apprentice Must Know: (Check all that apply)

- ☐ Name of tool(s)
 - ☐ Distinguishing characteristics of tools
 - ☐ Purposes or functions served by tool(s)
 - ☐ Procedures for using tool(s)
 - ☐ Causes of tool-related accidents
 - ☐ Safety procedures
 - ☐ Maintenance procedures
 - ☐ Scientific/physical principles underlying tool operation
-

List all major types of materials/parts/fixtures used on the job:

C. Apprentice Must Know: (Check all that apply)

- ☐ Common names for materials/parts/fixtures commonly used
- ☐ Distinguishing features/characteristics of different kinds of materials/parts/fixtures
- ☐ Function(s) of parts/fixtures/materials
- ☐ Methods and procedures for preparing materials
- ☐ Methods and procedures for storing materials
- ☐ Installation/application procedures
- ☐ Problems commonly encountered in the use of materials
- ☐ Testing procedures to determine whether parts/fixtures are effective or need replacement
- ☐ Order of assembly operations

D. Based upon the worker knowledges checked above please provide a statement of the specific knowledges required for each area checked.

Apprentice Must Be Able To: (Check all that apply)

- ☐ Select materials/parts/fixtures that are appropriate for the task at hand
- ☐ Prepare materials/parts/fixtures
- ☐ Store materials/parts/fixtures in a safe and proper manner
- ☐ Apply/install or otherwise use materials/parts/fixtures in accordance with commonly-accepted trade or craft standards
- ☐ Diagnose malfunctions to determine what parts need replacement or reconditioning
- ☐ Disassemble assemblies into component parts
- ☐ Assemble parts into subunits and/or assemblies

- _____ Operating procedures
- _____ Maintenance procedures/schedules
- _____ Principal causes of machinery/equipment function
- _____ Basic functions or purposes performed by machinery/equipment
- _____ Basic scientific and/or physical theories underlying machinery/equipment operation
- _____ Diagnostic methods and techniques used in machinery/equipment
- _____ Standards for judging quality of work performed
- _____ Methods for repairing machinery/equipment
- _____ General maintenance procedures

D. Based upon the general knowledge areas listed above, please provide descriptions of specific knowledge for each area.

B. Apprentice Must Be Able To: (Check all that apply)

- _____ Perform initial set up of machinery/equipment to perform their function
 - _____ Operate equipment/machinery or otherwise perform processes requiring continuous monitoring, controlling, regulating or maneuvering (e.g., driving motorized vehicles, operating cranes, hoists, saws, cutters)
 - _____ Operate machinery/equipment to rigorous standards of accuracy and precision
 - _____ Feed materials and/or off-load product
 - _____ Carry out detailed testing and/or diagnostic procedures requiring machine/equipment operation
 - _____ Maintain machinery/equipment
 - _____ Repair, overhaul, or otherwise recondition machinery/equipment
 - _____ Repair, overhaul or otherwise recondition machinery/equipment
-

with:

- ☐ How to listen and carry out instructions
- ☐ How to communicate intention and feelings to others
- ☐ Ways and means of motivating people
- ☐ How to influence others
- ☐ Principles and practices of good supervision
- ☐ How to train others
- ☐ How to be sensitive to the needs of others
- ☐ How to evaluate performance of others
- ☐ How to deal with people

D. Based upon the knowledge areas checked above, please provide descriptions of specific knowledge required for each of the checked areas.

Apprentice Must Be Able To: (Check all that apply)

- ☐ Follow verbal instructions from others
 - ☐ Communicate results and findings to customers, co-workers, supervisors or others
 - ☐ Counsel and advise others
 - ☐ Recognize and attend to the needs of others
 - ☐ Influence others in favor of a product, service or opinion
 - ☐ Supervise others
 - ☐ Negotiate, arbitrate or otherwise engage in delicate social bargaining
 - ☐ Train others by explanation, demonstration or supervised practice
-

After the listing of specific categories or data, people and/or things, the analysis sheets contain space to list a number of activities that apprentices perform on the job. If these activities are required in the performance of the job described in the work process description, then check each statement that applies. This operation focuses attention on specific types of work activities that are closely related to and supported by worker knowledges and understandings.

Given that these knowledge-dependent activities have been identified, the analysis sheet requires that the general knowledge areas be identified. These general knowledge areas have a close correspondence with activities previously identified. For example, with respect to machinery and equipment, if an apprentice must maintain machinery and equipment in operating order, then it follows that the apprentice must know the proper maintenance procedures. The analysis sheet is intentionally structured to lead analysts from the specific aspects of data, people or things through generalized work activities to a focus upon the general knowledge areas required to support that activity. The final requirement of the analysis sheet is a specification of the required specific knowledges. Accomplish this by reviewing the general knowledge areas checked and specifying in more concrete terms the nature of the knowledge to be acquired. For example, if it has been determined that an apprentice must know proper maintenance procedures, then the necessary specificity can be added by stating the major types of machines or equipment for which the maintenance procedures must be known.

The intent of the skills-knowledge analysis sheet is to provide a logical procedure for deriving the knowledges necessary to support job performance as described by the work activities. This procedure will provide an objective basis for the identification of required knowledge and will assure that knowledges identified will be those which are demonstrably related to job performance.

Identification of skills and knowledges is based upon the work processes descriptions. The skills-knowledge analysis should be performed sequentially. Once selected, the skills-knowledge analysis sheet should be completed in its entirety before going on to another. Work process descriptions should be used in the following manner. Study in detail the first work process and its associated work activities. Complete a skill-knowledge inventory sheet for that work process. Upon completion of the analysis sheet for the first work process, repeat the

entire procedure until all major processes and their associated tasks are analyzed. By doing the analysis in sequential manner, you avoid duplication because only those skills and knowledges not previously recorded are entered.

Conduct of the skills-knowledge analysis should be the responsibility of the Analysis Committee as constituted in Step 4. This Committee has been selected because of their knowledge of the occupation in question. It follows that they should be the most knowledgeable regarding the skills and knowledge requirements of that occupation. Because of the somewhat different mind-set involved, it is recommended that identification of work activities and analysis of the work processes to determine knowledge and skills be conducted in separate settings.

Whereas the previous analysis procedures dealt with identification of required knowledge, an occupational analysis is incomplete without an investigation of motivational and psychomotor requirements of the occupation. Procedures for performing these analyses are indicated in Figures 8 and 9.

As indicated in Figure 8, the motivational analysis sheet concentrates on the levels of apprentice motivation in terms of: (a) what they should be willing to do, (b) what they should find satisfaction in doing and (c) what they should be committed to doing. The analysis of those aspects considered important for an apprentice to be willing to do should concentrate on those aspects of the occupation which are not the most desirable nor pleasant parts, but which are necessary to be performed by anyone working in the occupation. Satisfaction deals with those parts of a job which apprentices should find rewarding to perform. Commitment is an even higher level of motivation and refers to the central values that should represent the driving motivational force. Together, these three levels of motivation allow a statement of motivational requirements to be constructed that will provide apprentices and applicants with information as to the motivational requirements of the apprenticeable occupation.

In a similar manner, the psychomotor requirements of the occupation can be determined. The intent of the psychomotor analysis is to identify physical activity requirements which significantly differ from normal expectations, either in terms of frequency, intensity, or special requirements. For example, if balancing is required for walking on narrow catwalks, then this would be considered a deviation from a normal balancing requirement of most occupations and should be indicated. The manner of indicating

people but are necessary to perform the job. Include items like working conditions, hours, travel, and s

Apprentice Should Find Satisfaction In: (List major kinds of work situations that apprentices should find re
items like performing changing duties, performing routine tasks, dealing with people, working under
difficult problems, and so forth.)

Apprentice Should Be Committed To: (List major areas that should be the central concerns for all app
items like safety, quality, customer satisfaction, craftsmanship, and so forth.)

Coordination To: (Check any of the following activities which require unusual or strenuous physical requirements.)

physical activities for each activity checked a

- | | |
|----------------------------------|--------------------------------------|
| <input type="checkbox"/> Walk | <input type="checkbox"/> Carry |
| <input type="checkbox"/> Crawl | <input type="checkbox"/> Push |
| <input type="checkbox"/> Run | <input type="checkbox"/> Pull |
| <input type="checkbox"/> Climb | <input type="checkbox"/> Grasp |
| <input type="checkbox"/> Balance | <input type="checkbox"/> Position |
| <input type="checkbox"/> Stoop | <input type="checkbox"/> Turn-twist |
| <input type="checkbox"/> Kneel | <input type="checkbox"/> Swing |
| <input type="checkbox"/> Crouch | <input type="checkbox"/> Assemble |
| <input type="checkbox"/> Stand | <input type="checkbox"/> Disassemble |
| <input type="checkbox"/> Sit | <input type="checkbox"/> Write |
| <input type="checkbox"/> Reach | <input type="checkbox"/> Draw |
| <input type="checkbox"/> Step | <input type="checkbox"/> Draft |
| <input type="checkbox"/> Lift | <input type="checkbox"/> Talk |
-

requirements are being identified. Once completed, the Analysis Committee will have performed a valuable service in that they will have identified the work activities to be performed and the knowledges, motivations, and psychomotor abilities required to perform those activities. These requirements are at the core of planning for an apprenticeship program. They serve as the basis for developing the related knowledges and understandings of those apprentices who possess the necessary motivational and psychomotor capabilities to perform on the job.

Example

The ABC Construction Company is a medium-sized firm specializing in highway construction. During the past five years, the company has been experiencing a shortage of qualified heavy equipment mechanics. General foreman, Santos Garcia has become particularly concerned about this problem and is convinced that the shortages will become critical unless something is done quickly. His concern builds to the point that he discusses the situation with the company personnel manager, Bill Anderson. Garcia finds that Anderson shares this concern. They decide to find out whether other construction firms in the area are having similar problems. Anderson telephones several of his counterparts in other construction firms and verifies that they, too, are experiencing similar hiring difficulties. During the course of the conversations, someone suggests that perhaps some action be taken jointly. Anderson is sympathetic to the suggestion and devotes time to exploring the sources of labor supply for heavy equipment mechanics. He calls the secondary school system and is told that no vocational program exists in that area. He also contacts the local technical institute where he is told that they are aware of a demand in that area, but that equipment costs are so great that they are reluctant to initiate a program.

warrant assuming the training burden. He discusses the idea with Garcia, who agrees that on-the-job training would be an ideal way to train heavy equipment mechanics, but also has reservations about the limited number of firms and the cost involved.

In the course of their conversation, they come to the conclusion that such training would be feasible if the training could be jointly provided by several employers. Anderson agrees to explore this possibility. He contacts the personnel and training directors of other construction firms in the local area. Representatives in five firms express interest in jointly sponsoring a training program for heavy equipment mechanics. The five meet as a group to discuss the outline of a training program. They decide that the apprenticeship model seems to be the best option. As a result of natural outgrowth, this group is formally constituted as an apprenticeship committee and is charged with the responsibility of developing an apprenticeship program for heavy equipment mechanics.

Their first order of business is planning the apprenticeship program. Since five firms are involved, the committee members feel it necessary to establish a formal description of the work activities performed by heavy equipment mechanics. Because none of the personnel or training directors feel they have sufficient knowledge of the work, they delegate this responsibility to their general foremen.

The general foremen meet as a group to identify work activities. They use the procedures described in Step 1 to develop their processes description. The work processes description developed by this group is in Figure 10.

Based upon the above work processes, the Analysis Committee determines the knowledges, motivations, and psychomotor skills necessary to perform these activities. For purposes of this example, only the skills-knowledge analysis pertaining to the use of tools will be presented. The analysis sheet filled out by the Committee is presented in Figure 11.

- c. Mount and adjust construction machinery equipment.
 - d. Position construction equipment in proper mounting alignment.
 - e. Mount construction equipment using proper mechanical fasteners.
 - f. Connect mechanical, electrical and hydraulic linkages and controls.
 - g. Inspect controls to verify that they are operating properly.
 - h. Field or shop test mounting to insure proper operating condition.
2. Service and repair running gear.
 - a. Inspect track chains, track rollers, front idlers, top idlers, pads and wheels.
 - b. Remove, repair and install track chains.
 - c. Remove, repair and install track rollers.
 - d. Remove, repair and install front and top idlers.
 - e. Remove, repair and install pads and wheels.
 - f. Inspect and install wheel drums.
 - g. Remove, inspect, replace and lubricate wheel bearings.
 - h. Inspect, adjust and replace brake shoes.
 - i. Inspect, disconnect, clean, overhaul and replace brake cylinders.
 - j. Inspect and replace brake lines.
 - k. Inspect, test and replace steering linkage components.
3. Service and repair power train assemblies.
 - a. Drain and replace power or lubricating fluid supply.
 - b. Disconnect, adjust and reconnect control linkages.
 - c. Remove, service and replace universal joints.
 - d. Remove, inspect, repair and install clutches.
 - e. Disassemble, inspect, replace parts, adjust and reassemble transmission and torque converters.
 - f. Remove, inspect, adjust, replace parts and install differentials and final drives.
 - g. Detect running faults in transmission, torque converters, differentials and final drives.
4. Service, repair and overhaul gas and diesel engines.
 - a. Drain, change filters, replace and replenish chassis lubricants.
 - b. Remove, inspect, repair and install engine

- c. pumps and filter.
 - d. Remove, clean, inspect and replace valve heads.
 - e. Remove, clean, replace parts and install valve lifters.
 - f. Inspect, remove and replace camshaft sprockets and gears.
 - g. Remove, clean, inspect and replace valves.
 - h. Remove, inspect, analyze wear, replace and install bearings.
 - i. Grind valves and ream valve seats.
 - j. Remove, clean, inspect and replace distributor drive.
 - k. Clean, inspect and ream cylinder bores, remove pistons.
 1. Remove connecting rods capscrews and reassemble.
 - m. Inspect and deglaze cylinder bores.
 - n. Assemble pistons.
 - o. Inspect connecting rods, ream and replace pistons.
 - p. Detect and diagnose engine faults.
5. Service and repair fuel system.
 - a. Remove, clean and inspect air filter.
 - b. Remove, clean, replace and install fuel filters.
 - c. Remove, test and replace fuel pump.
 - d. Inspect, remove, repair and replace fuel and filler pipes.
 - e. Remove, replace and tune carburetors and injectors.
 - f. Dismantle, inspect, replace parts and install carburetors and/or fuel injectors.
 - g. Check and balance fuel injection.
6. Service and repair electrical system.
 - a. Inspect, test and service battery.
 - b. Inspect, test and replace bulbs and switches.
 - c. Test circuitry.
 - d. Check, inspect, repair, and replace electrical connections.
 - e. Inspect, repair and replace wiring and terminals.
 - f. Remove, clean and install generator and alternators.

A. List all major types of tools used.

1. Hacksaws, chisels, handcutters and other cutting tools
2. Pliers, clamps, vices and other holding tools
3. Wrenches, screwdrivers and other threaded fastening tools
4. Hammers, punches, drifts and other driving tools
5. Twist drills, reamers, borers, tools and coolants
6. Portable and bench power tools
7. Torquing devices
8. Taps, dies and other threading devices

B. **Apprentice Must Be Able To:** (Check all that apply)

- ☒ Select appropriate tool(s) for task at hand
- ☐ Make necessary set up or adjustments required to prepare and use the tool(s)
- ☒ Use tool(s) in a safe and proper manner
- ☒ Provide for routine care and maintenance

C. **Apprentice Must Know:** (Check all that apply)

- ☒ Name of tool(s)
- ☒ Distinguishing characteristics of tools
- ☒ Purposes or functions served by tool(s)
- ☒ Procedures for using tool(s)
- ☒ Causes of tool-related accidents
- ☒ Safety procedures
- ☒ Maintenance procedures
- ☐ Scientific/physical principles underlying tool operation

D. **Based on the worker knowledges checked above, please provide a description of the specific know**
each area checked.

1. Learn names of all major classes of tools used, e.g., cutting tools, holding tools, fastening tools, reamers and boring tools, portable and bench bar tools, torquing devices, and taps, dies and devices.
 2. Must know the characteristics that distinguish major types of hand and power tools used.
 3. Must know the major purposes and uses of each class of tools.
 4. Must know how to operate each class of tools in a safe and proper manner.
 5. Must know the major hazards associated with the use of each major type of hand and power
 6. Must know the safety procedures to be used in order to avoid major tool hazards.
 7. Must know how to maintain a class of tools in proper operating order, including cleaning, l procedures.
-

Self-Test Exercises

Answer the following questions in the space provided or on separate work paper. Compare your answers with those provided in the Appendix of this booklet.

1. List at least three ways to assess the need for apprenticeship training. For each method, identify a positive and a negative argument for its use.

Method

- a.
- b.
- c.

For

- a.
- b.
- c.

Against

- a.
- b.
- c.

2. You have been called upon for ideas as to how support for an apprenticeship program may be developed. Outline a series of steps that could be taken.

4. Outline the procedure for constructing a process description.

5. Which of the following statements best describes work activities descriptions?

- a. Inspects castings for visual defects
- b. Familiar with reporting procedures
- c. Troubleshoots control panels
- d. Erects external siding according to plans
- e. Understands application of Ohm's law in design

6. Consider a specific apprenticeable occupation in which you are familiar. Outline the steps in determining the *people related* skills and knowledge.

3. Skill: Establish Goals And Objectives For The Apprenticeship Program

Introduction And Objectives

Once the required knowledges, motivation and psychomotor abilities have been identified, a program must be designed for their attainment. The program design consists of two separate components: (a) the basic standards that describe the characteristics and procedures of the program and (b) the statement of goals and objectives that indicate what the program intends to accomplish and the means for accomplishment. For the sake of clarification, standards have been divided into those that pertain specifically to the training activities and those that pertain to the administration of the training program. Standards that refer to conditions of training are referred to as *training standards*. Those that pertain to administration are termed *administrative standards*. *Goals* refer to those broad statements that describe the overall purpose of the training program. The means chosen for the achievement of these goals are termed *objectives*. Upon completion of this unit of materials, you should be able to demonstrate your competency in being able to:

1. Define the purposes served by apprenticeship program basic standards;
2. Identify the topics to be covered by basic program standards;
3. Construct and critique specific program standards;
4. Specify the distinction between program goals and objectives; and
5. Write and critique specific program goals and related objectives.

Why Do We Need Standards And How Do They Relate To Goals And Objectives?

If you think of planning as creating an organizational design to manage training, then standards serve as the blueprints of the training system. They show how the training will be organized and operated. Just as blueprints, standards are a guide to the construction of the training system and

managed and the rules and procedures governing operation.

Whereas standards are statements of what the program is, goals and objectives are statements of intended results and procedures for the program. Program goals are statements of results expected to be achieved at some future date. They are broad targets that the program seeks to achieve. When taken together, they describe the mission or purpose of the program.

In contrast to goals, objectives are more immediate statements of short-term results necessary for goal attainment. Objectives should:

- be worthwhile and significant;
- make a real contribution to program goals;
- be set neither so high as to make them unattainable nor so low that their achievement is meaningless;
- suggest appropriate strategy procedures and techniques for the attainment of related goals;
- indicate numbers to be served, skills to be developed and/or other measurable quantities that can be used to evaluate attainment of program goals;
- be precisely stated to reduce the possibility of misunderstanding their intent;
- be shared with those who have a stake in the apprenticeship program outcomes.

How To Set Standards

Work Processes

The most central training standard is that providing the work processes description (refer to Chapter 2-Steps). As you will recall, the work processes description states the general divisions of the apprenticeable occupation and the associated work activities that fall under each major division. These work activities are sequenced in the order in which they are to be learned. Taken as standards, the work activities provide the specification for the content to be learned in the course of the apprenticeship. They serve as ready communicators of the content areas to be learned and place the emphasis directly upon observable

Related instruction refers to the learning that takes place, usually in a classroom situation, that is designed to provide the knowledges and understandings needed to support and supplement actual job performance. The content consists of those concepts that flow from the application of more basic theories and practices to on-the-job experience. More basic theories and practices provide models that apprentices can use to derive meaning from their experiences and to explain why things happen as they do on the job.

Because these theories and models are more generalizable and are more difficult to infer from job experiences, it is frequently more efficient to deal with them in a classroom setting where the apprentice is free to engage in the more abstract considerations necessary for their understanding. A fundamental point of importance, however, is that these more basic and abstract theories, principles and models are of importance only to the extent they assist the apprentice to interpret his/her job experience and to reform his/her craft/trade more effectively.

The task is to decide which knowledges can be learned on the job and which knowledges can be learned best in a related instruction context. This task can be approached by reviewing the knowledges identified in the skills-knowledge analysis sheets as described in Step Five of the previous Chapter. Each skills analysis sheet contains a listing of those knowledges identified as contributing to the performance of job skills. Each knowledge statement could be assessed to determine whether it can be learned on the job, in a related instruction setting or in both settings. Make the decision by using the following criteria:

On-The-Job Training

- Can be used to impart knowledge in situations where apprentice can learn from direct observation and where there are standard operations, techniques and/or practices that can be observed and modelled by the learner;
- Is particularly well-suited to situations where the apprentice can infer desired knowledge from actual hands-on experience and can profit from trial and error, and where there are definite performance standards that can provide immediate knowledge of results that reward the learner for correct behavior.
- Most useful when mistakes are not overly costly in terms of spoiled material, damaged equipment.

resultsants of the theory can be observed;

- Situations where trial and error learning may be inappropriate; e.g., operational procedures where safety factors may prevent trial and error learning in situations that occur relatively infrequently but are critical when they do occur, and situations where verbal descriptions may provide an acceptable substitute for actual experience.
- Can provide a simulation of on-the-job behavior as to reduce risk and cost.

Each knowledge statement should be evaluated according to the above criteria and a decision made as to whether it is more appropriately learned on the job, in a related instruction situation or a combination of the two. Repeat this procedure until all the knowledge statements identified in Step 5 of the preceding chapter have been appropriately classified. The result will be an objective determination of the knowledges to be learned in related instruction.

These knowledges when collected together and presented as a list constitute the content standard for related instruction.

Safety And Health Training

Review the knowledge statements on the skills-knowledge analysis sheet to determine which statements apply to safety procedures. Identify, group and report separately the safety knowledges. They are the safety and health training standards for the apprenticeship program. If desired, these statements may be supplemented by a statement that provides assurances that these knowledges will be developed in a healthful work place that meets applicable federal and state requirements.

Term Of Apprenticeship

Review the work processes of the apprenticeable occupation and determine the number of instructional hours required to develop journeyman competencies in the work activities. The decision should assume a journeyman with average mentality and capabilities and without creditable prior work experience to draw upon. The number of hours for similar apprenticeship programs

Once a total number of hours has been determined, proportion the total number of hours across the major occupational divisions contained in the work processes description. Given that a specified number of instructional hours has been assigned to each major occupational division, allocate the hours to each work activity within that division. Thus, the finished product will be an allocation of the total number of instructional hours to each work activity comprising the work processes description. Instructional hours so allocated become the standard and serve as the basis for management of the apprenticeship training. Instructional hours also should be allocated to related instruction. Review each knowledge statement and estimate the number of instructional hours required to develop competency in that knowledge area. Total the instructional hours assigned to related instruction and review the total in comparison with the total number of instructional hours. If the number of instructional hours assigned to related instruction appears disproportionately large or small, the allocation procedure can be modified accordingly.

The result of this process is an assignment of instructional hours to related instruction based upon the knowledge to be learned in training other than on-the-job training. This provides a specific and defensible argument for the assignment of specific numbers of instructional hours to related instruction. These hours, once specified, constitute the standard with respect to the number of program hours devoted to related instruction.

Probationary Period

A probationary period should be established during which the apprentice must demonstrate his/her capability to learn the skills necessary to function as a craft/desperson. As a general rule, a period of one year is a commonly-accepted probationary period. Whatever the period, the means of appraising apprenticeship performance to determine whether the apprentice has passed the probationary period should be made explicit. Performance appraisal is generally a function of supervisory evaluation and is described in the next section.

by the immediate supervisor in terms of job performance and by the related instructor. For the case of the apprentice supervisor, it is recommended that performance be rated on a simple five-point scale with scale values being interpreted as follows:

- 0- Apprentice unable to perform work according to acceptable standards;
- 1- Apprentice requires direct supervision and considerable assistance in defining the task to be performed, selection of tools, handling of materials, sequencing of job activities, and so forth;
- 2- Apprentice can work unassisted on job under fairly routine standardized conditions but requires assistance in getting started and in dealing with unexpected problems, events and circumstances;
- 3- Apprentice able to work without assistance in work activities under standardized conditions, may require occasional assistance in dealing with special problems and/or in diagnoses of malfunction when dealing with other unusual circumstances;
- 4- Apprentice able to perform as journeyman, work without direct supervision and successfully performing/solving all work-related problems.

Arrangements should be made for periodic assessment of apprentice performance. The apprenticeship supervisor initially should rate the competency of the apprentice in every activity in the work process description using the five-point scale. A meeting should be arranged with the apprentice to provide him/her an opportunity to rate his/her own performance using the same scale. Compare the apprentice's self-rating with the supervisor's rating to determine areas of discrepancy.

It is recommended that an apprentice, in conjunction with the supervisor, work out a plan by which the apprentice develops competencies in specified work areas. This plan may be very informal and consist of more than an agreement between the apprentice and supervisor as to the work activities on which the apprentice will concentrate and an approximate date for attainment of that competency. A more formalized plan might identify specific work activities on which the apprentice intends to concentrate, describe learning activities, and specify target dates.

apprentice on which to record progress. Note supervisor ratings beside each work activity with the date of the rating. The personalized work process description is a record of individual performance.

Ratings can be used to determine the rate of apprentice progress towards attainment of that particular competency. A personalized work process sheet can also be used to keep a running record of the actual hours that each apprentice has logged in towards obtaining competency for that particular work activity. By comparing the number of hours actually expended with the number of hours allocated and the progress towards competency attainment, the supervisor has a valuable tool to use in the appraisal of apprenticeship progress. A formalization of the work process descriptions as a recordkeeping device for apprentices can be used to constitute the standard.

Supervisory Ratio

The number of apprentices to be supervised by each journeyman should be specified as a program standard. The standard insures that the apprentice/journeyman ratio does not become too large so as to preclude efficient supervision. A general rule of thumb in principles of management is that the span of control should not exceed seven to nine. Translated to apprenticeship training, this would mean that ideally no journeyman should supervise more than seven to nine apprentices, unless unusual circumstances are present. In practice, given that journeymen must supervise *and* train apprentices, probably five apprentices per journeyman is a sufficient number. Remember, because apprentices move from work station to work station across the apprenticeship term, each apprentice will (and should) work with a number of different journeymen.

Qualification For Apprenticeship

Standards should be prescribed that indicate admission requirements. To the extent possible, admission requirements should be based on objective evidence that the requirements are related to performance in the apprentice program. The motivation and physical abilities identified in the previous chapter provide an ideal source for admission requirements. Recall that the Analysis Committee specified all physical activities that required exces-

an objective rating system for the determination of admission standards. Admission standards should include minimum age. As a general rule, apprenticeship ranges from sixteen to eighteen.

Equal Opportunity

Equal access to training opportunity and is important to ensure that all have the opportunity to apply. Apprenticeship standards should incorporate into their standards such that the recruitment, selection, employment of apprentices shall be done without regard to race, color, religion, national origin. Consult the Code of Federal Regulations — Part 1600. Consult it as a basis for formulating standards for equality of opportunity and access. Obtain guidance from the Department of Labor on outreach and expansion programs and models.

Apprenticeship Agreement

A central distinguishing feature of apprenticeship training is that there is a legal agreement between the sponsor and the apprentice. This legal agreement provide for:

- The name of the apprentice;
- Address of the apprentice;
- Signature of parent or guardian;
- Name of employer and address;
- Signature of authorized company representative;
- Provision for approval by the apprenticeship committee;
- Provision for sign up by registered apprentice;
- Title of apprenticeable occupation;
- Probationary period;
- Term of the apprenticeship;
- Credit for previous experience;
- Date apprenticeship begins;
- Term remaining;
- Biographical information on apprentice including ethnic group, highest education level;
- Inclusion of standards pertaining to the apprenticeable occupation.

In some instances, the apprentice is indentured directly to an employer. In other instances, the apprentice is indentured directly to an employer through a joint apprenticeship council rather than an employer. In either case, the contract is between the apprentice council and the apprentice.

It is recommended that a standardized legal contract be drawn up and used for all apprentices in the program. This apprenticeship form then becomes a standard document for the apprenticeship program. Since the contract is a legal document, services of a lawyer to review the legality of the proposed form is advisable unless a standardized contract form designed by the State Apprenticeship Agency or "BAT" is used.

Credit For Previous Experience

Procedures should be developed that provide for credit for apprentices for competencies gained from previous experience. Allocation of credit for previous experience should be based upon a review and assessment of work activities, using the rating scale as previously described.

One way to determine credit for previous work experience is to assign percentages for each scale value. For example, you might provide 25% credit for a rating of 1, 50% credit for a rating of 2, 75% credit for a rating of 3, and 100% credit for a rating of 4. Thus, an apprentice who demonstrates a competency in a particular area can ask for and receive a performance rating. Based on the rating, a portion of instructional credit will be granted. Other schemes for awarding credit include credit for prior training experiences, credit for prior supervised work experience, and credit awarded on results of performance tests such as the National Occupational Competency Tests. Remember, the more you know about the competencies required of a craftsperson and the more highly developed your testing program, the easier it is to determine the value of prior experience. Also, remember that in some programs, prior credit is withheld until the probationary period is passed. The procedure, once formalized, should be constituted formally as a program standard.

Wage Schedule

Provision for a progressive wage based upon progress through the apprenticeship program should be included as a program standard. Wage progression arrangements may vary from advancement based on time in the program

Recognition For Completion

Apprentices should receive formal recognition for completion of the program. Recognition may take the form of a certificate or diploma signed by the appropriate official. The certificate attests to apprentices having completed the program training requirements. Make certain that the certificate or diploma has an official look, that it is signed by the appropriate official and that it attests to the fact that the named apprentice did in fact complete all program requirements. Often it is useful to record the work activities that the apprentice is capable of performing. The work process description can be printed on the certificate or as an attachment. Work process descriptions, if included, should be signed by appropriate officials signifying that the apprentice has demonstrated competency in the areas so indicated.

Union/Management Cooperation

In those areas covered by collective bargaining agreements, provisions should be made for including union representation in all areas of apprenticeship program standards. The specified procedures by which union contributions are incorporated into the design of the training program should be included as a formal standard.

How To Establish Goals And Objectives

A goal is a results-oriented statement of intent. Goals are written and provide a general description of an outcome selected to satisfy an individual sponsor or community need. Goal statements clearly designate the desired outcome to be attained as well as who will benefit from attainment of this outcome. Possible outcomes from an apprenticeship program include:

- Provide a pool of trained craft workers to meet the present and future sponsor/employment requirements;
- Assure a supply of skilled workers that will support community economic development expectations;
- Provide increased quality of goods and services produced;
- Increase worker productivity;
- Provide workers a greater degree of job security that comes from having a skilled trade or craft that is

Verbs Commonly Used With Goals

increase
expand
enhance
develop
improve
optimize



decrease
reduce
diminish
lessen
shorten
curtail



Formulation of goal statements requires that expected outcomes be linked with specific target groups. Target groups with special relevance for apprenticeship programs include:

- Apprentices of all types including adults, youth, women, minorities, veterans;
- Business and Industry
 - Organizational divisions within a specified firm;
 - Sponsoring business firms and organizations;
- Unions
- Local community
 - Employer groups and/or associations;
 - Community residents;
 - Local businesses dependent upon community prosperity;
 - Local economic development.

Example Of A Typical Goal Statement

To Improve The Recruitment of Young Women Into The Apprenticeship Program

Outcome
Target Group

An *objective* is a detailed and specified description of an outcome. Usually it is written and describes the intended results and objectives in measurable terms. There may be several objectives for each goal. Usually good planning specifies no more than three or four objectives for each goal. Objectives are the means for the achievement of apprenticeship program goals. The fact that objectives focus on means rather than final outcomes provides the basic distinction between goals and objectives.

Objectives should state: (a) what action is to be taken to achieve the goal; (b) what measurable results are to be anticipated to be achieved by the action; and (c) within what time period the results are to occur.

To illustrate how objectives differ from goals, consider the goal: *to increase the versatility of skills necessary to*

- used in the apprenticeable occupation;
- To review within the next eight months the various processes descriptions in light of change in technological requirements;
- To revise by the end of the calendar year the various processes descriptions to reflect changing technological conditions.

Objectives should begin with strong action-oriented verbs that describe an observable or measurable behavior. The following list illustrates the broad range of program actions that are supportive of goal attainment.

Verbs Commonly Used With Objectives

design	implement
prepare	place
involve	serve
inform	support
offer	encourage
provide	enable
stimulate	communicate
review	coordinate

Goals and objectives can be formulated according to a five-step process. Each step represents a set of activities that should be performed in logical order.

Step 1: Assign Responsibility To A Designated Group

Responsibility for formulating goals and objectives should be assigned to a specific group. The most reasonable assignment of responsibility would be to the Apprenticeship Committee which has responsibility for all program planning. Goals/objectives formulation is a necessary part of planning responsibilities.

Step 2: Secure And Utilize Necessary Supportive Information

In order to insure that goals/objectives are based on available evidence, data from a number of sources should be assembled and utilized by the Apprenticeship Committee in the goal/objective formulation process. Information should be obtained from the following sources:

- Program standards;
- Skills-Knowledge Analysis Sheets;
- Motivation and Physical Requirements Analysis Sheets;
- Sponsor expectations as to program results;

- Expectations from community support groups;
- Descriptive information of similar programs conducted in other localities;
- Available information from State Apprenticeship Agency and/or BAT representative;
- Union expectations as to program outcomes;
- Data from local employers indicating need for apprenticeship program;
- Statements of support from community leaders;
- Standards prepared by National Apprenticeship Committee;
- Relevant Department of Labor materials.

Step 3: Identify The Target Groups To Be Served By The Apprenticeship Program And The Specific Needs Of The Group Filled By The Program

For each identified target group, specific needs may be developed by the Apprenticeship Committee, either as a group or individually. When all the needs have been identified, then the group can turn to the separate discussion of each identified need. Choose a particular procedure based upon the individual styles and preferences of committee members.

Step 4: Define The Apprenticeship Program Outcomes That Best Serve Identified Target Group Needs

Once the needs of various target groups have been identified, identify the program outcomes considered to satisfy these needs. As a general rule, specify no more than two or three outcomes for each identified need. Outcomes may be solicited formally from each Apprentice Committee member or generated from free group discussion. In the case of disagreement between Committee members, try to secure agreement on the suitability, practicality and general intent of the outcome statements. Retain only those outcome statements for further consideration on which consensus is obtained.

Step 5: Formulate Objectives For Each Goal

Once outcomes have been defined, they can be translated into goal statements by linking outcomes with responding target groups. Then objectives should be formulated for each goal. The Apprenticeship Committee must insure that objectives are measurable and specified. Further, objectives must serve the goals formulated in Steps Three and Four. Each objective should state only a single aim or purpose and should specify a single end product or result within a specified time frame.

ment mechanics apprenticeship program serving five employers. The Apprenticeship Committee consists of personnel and/or training directors representing the sponsoring firms. During the early stages of planning the program the Apprenticeship Committee has met frequently to discuss the major purposes to be accomplished by the program and to set the program standards that will serve as guide program administration. One area that Bob Anderson, the ABC Company Personnel Director, was particularly interested in dealt with evaluation of apprenticeship progress and recordkeeping. He was personally convinced that knowledge of apprenticeship progress should be made available to the individual apprentices and used to motivate their performance. He was further concerned that the assessment of apprenticeship performance should not be regarded as a test with negative consequences if it failed, but rather as a verification that the apprentice had indeed advanced to another plateau of competency. He was also firmly convinced that apprentices should be given much of the responsibility for their own learning. He was successful in persuading other Committee members to accept this view and to design a rating and record system that incorporated this philosophy.

The assessment system designed by the Committee provides for a large amount of interaction between the supervisor and the apprentice in the evaluation process. Upon entry into the apprenticeship program, the system provides for apprentices to rate the level of their competency on each of the work activities in the work process description. Some Committee members initially raised questions about the wisdom of allowing apprentices to rate their competencies. The argument in support of self-ratings was that the self-rating exercise would expose the apprentice to the range of work activities for which competence was required as well as focus the apprentice's attention on the assessment of their present skills level. Rather than tending to overrate themselves as some firm members feared, the consensus of Committee opinion was that the apprentices would be realistic in their self-appraisal and, if anything, would tend to be conservative in their self-appraisal.

Upon completion of the initial self-rating, the design calls for the apprentice and his/her supervisor to meet and to discuss the self-ratings. The supervisor's role is to assess the apprentice in terms of formal qualifications and observations of performance and to interpret the apprentice's self-rating against the supervisor's perception. The result of this meeting is consensus between

ground for this original meeting, the supervisor and apprentice agree upon certain work activities that the apprentice will concentrate upon in the near future. Work activities are identified, bearing in mind the apprentice's level of ability. The supervisor and apprentice agree that the apprentice will concentrate on the identified activities as identified in the contract. Approximate dates for moving to the next level on the rating scale are identified and agreed upon in principle by both the apprentice and the supervisor. This informal contract is expected to make the apprentice aware of the learning expectations of the supervisor for the future. Also, it provides the apprentice a goal on which to concentrate his/her activities. From the standpoint of the supervisor, it provides a rationale for work activities that contributes to apprentice growth.

The proposed system also provides for an assessment of the apprentice's skills when the apprentice feels that he or she has mastered that assessment. This raised some questions among some Committee members who were doubtful of the value of allowing apprentices to determine their own performance should be rated. The counter argument was that continual assessment on demand places the apprentice responsibility for directing the rate of learning and requires more self-autonomy with corresponding motivational value. Once the apprentice determines that he or she has mastered the work activity, a formal rating is made to the supervisor. The supervisor has the prerogative to refuse this request if there is no belief that the apprentice is obviously not ready. The supervisor rates the apprentice using a continuous scale. Accumulated evidence gained from continual observation of the apprentice at the work station and of the apprentice's performance on a specific piece of work that was agreed upon to be a job sample. Concentration upon a specific work activity allows the supervisor to use specific evidence to support his rating.

Additional Information

For more information on developing goals and objectives, you could refer to the following:

Education and Training for Older Persons: A National Curriculum Guide. Washington, D.C.: U.S. Government Printing Office, 1981.

Answer the following questions in the space provided on a separate work paper. Compare your answers with the answers provided in the appendix of this booklet.

1. Describe the purpose served by apprenticeship program standards.
2. List the topics that should be covered by apprenticeship program standards.
3. The Tri-Town Area Apprenticeship Council has requested assistance in determining standards regarding related instruction. What procedure for constructing these standards would you recommend?
4. How do goals and objectives differ?
5. Suppose that you were called upon to develop objectives for an apprentice program. What criteria would you use in writing objectives?

Part 1: Skill: Incorporate Ideas That Facilitate Upgrading of Program To Keep Current With New Technology. New Training Ideas And Changes Occurring In The Occupation

Introduction And Objectives

Change is a way of life. Although always present, it is now more than ever important to be able to adapt to the use of new technology. The information revolution has replaced the industrial revolution and no one is isolated from its effects. The age of electronics and progress in micro-chip technology is altering our lives. The computer is expanding our capacities at an explosive rate and is changing the way work is performed. This change cannot be ignored by those programs that develop the trades and crafts skills that make our standard of living possible. To be more responsive to the changing demands of technology presents a continuing challenge to apprentice training. As you work through the material in this unit, you must strive to sharpen your awareness about the nature and direction of technological change and its implications for apprenticeship training. When you complete this unit, you should have the competencies to:

1. Locate one or more new technologies likely to change occupational skills requirements;
2. Critique and identify new technology to determine skills implications;
3. Revise work processes to account for changing skills requirements;

Why Be Concerned With Technological Change?

Technology is changing at an explosive and, to some, an alarming rate. We stand on the threshold of an information revolution that likely will surpass in magnitude the developments accomplished during the industrial revolution. Tiny micro-chips that can rest on the head of a pin have made possible the development of desk-sized micro-processors that accomplish what a room full of computers could only a few short years ago. Light, when properly used, can be used to cut metal. Computer-controlled

productivity and to maintain a competitive position in world markets.

Technological change influences work in varied and changing ways. In some instances, existing skills will become obsolete. In others, the technology will upgrade existing skills by placing an increasing premium upon diagnostic and problem-solving capability or by requiring new skills in order to work with new materials, machines or processes. Whereas technology may eliminate some jobs, it will create others. Although the exact impact of technology is difficult to predict, it certainly will influence to some degree most apprenticeable occupations. The anticipation of forthcoming technological changes and the modification of apprenticeship programs to accommodate these changes is the responsibility of good program planning.

How To Keep Apprenticeship Programs Current

Technology seldom changes abruptly enough to render an occupation totally obsolete. What happens instead is that over a period of time, the occupation changes to accommodate the skills required by the technology. The rate of that change depends upon the speed at which the technology is adopted. If apprenticeship training is to be a viable training mode, it must produce journeymen with the skills demanded by the current state of technology. If it does otherwise runs the risk of preparing people whose skills are obsolete and their resources wasted in terms of potential benefit to society.

Updating apprenticeship programs to insure that they are in accord with current technological requirements is a three-step process. New and changing technological demands first must be identified. Once identified, the implication of these technological changes with respect to skills training can be assessed. The capabilities of existing apprenticeship programs to produce competencies

Step 1: Identify New Technologies That Likely Will Impact On The Occupation

This task requires knowledge of the state-of-the-art technologies that soon will be available in the marketplace and are expected to influence current craft skill requirements. These technologies may be incorporated in new machinery and equipment, materials, tools, or changes in marketing, sales, distribution or manufacturing processes that can be expected to influence the apprenticeable occupation. Locating these technologies requires the development of an intelligence network that provides information as to forthcoming changes in products and procedures. Important sources for information about anticipated technological changes include:

- Trade publications;
 - Manufacturing sales representatives;
 - Trade associations;
 - Universities and community colleges (especially those that have an extension service);
 - Newsletters that specialize in new technology identification;
 - Consultants;
 - Other industry representatives.
- This information should be systematically collected and periodically reviewed to determine its implications for the apprenticeable occupation. The review should concentrate upon determining whether the technology is currently available in the marketplace, and what would be the likely rate and scope of its use by business and industry. Determination of use frequently will involve assessment of the likelihood that one of several available prototypes ultimately will become the industry standard.

The Apprenticeship Committee should bear the central responsibility for reviewing the technological scene and for determining which technologies have the greatest likelihood of changing the skill requirements in apprenticeable occupations. The committee must decide the extent to which new technologies will have a direct influence on the shop floor. If the technology appears destined for use by the industry, then it is the responsibility of the apprenticeship program to incorporate this change into its training plan.

Step 2: Assess Impact On Training Requirements

Once a technology has been identified as having the

Product descriptions should be carefully reviewed and areas of change pinpointed. These areas of change must be scrutinized to determine whether existing skills will suffice or whether new skills will be required. In some instances, the technological change will require only that the craftsman have knowledge of the properties of a material or a minor modification of an existing process. In other instances, the technology will alter completely the nature and sequence of the work activities and will require the learning of new skills. Electronic components are a particular case in point. If the electronic component is modularized and repair is simply replacement with another like unit, then the impact of the technology is relatively minor. If, on the other hand, repair does involve interchangeable units and must be performed on site, then the skills impact of the technology could be considerable. Such characteristics of new technology must be carefully reviewed to determine skills impact.

For each technology that has been identified to impact the occupation in question, a description of the work skills requirements should be prepared. Worker skills analysis should describe the worker skills in terms of

- Information to be processed;

- Operational processes;

- Repair skills;

- Routine maintenance skills;

- Problem-solving skills; and

- Changes in organization of work that would alter people-related skills.

The apprenticeship committee should document the findings. Documentation should be organized according to major skills areas. This documentation may be formal in the case of a report or informally presented as a discussion document. The important point is that an attempt be made to determine the implications that new technology will have for craft skills.

Step 3: Update Apprenticeship Program To Take Into Account Anticipated Skills Requirements Due To Changing Technology

The results of the skills analyses performed in Step 2 should be used as a criteria to assess the adequacy of the existing training program. Compare the work activities and their associated knowledges against the skills required by the new technology. Review existing work activities

asis on other skills be reduced while keeping the er of total hours constant or must additional hours be ?

decision about whether the skills should be pped, whether on the job or in related instruction, must be reconsidered. If assigned to related instruc- the impact on the total number of apprenticeship assigned to related instruction must be reevaluated. h changes will affect program standards. Make the explicit by revising standards accordingly. Only h the development of such a procedure for systema- determining the effects of technological change can p apprenticeship program be considered truly respon- o the apprentice, the sponsor, the community and .

Example

Clover Manufacturing Company sponsors an ap- ceship program for machinists. The company, as part ajor capitalization effort, has been considering the ition of computer-controlled milling machines. The anager, the production engineer, and the purchas- ent have been investigating the market with respect ppeting manufacturers. In the course of their delibera- they have collected information about computer- lled milling machines and their capabilities.

ing heard about the interest in moving from numeric mputer control, Sandy Dickerson, Chairperson of the p apprenticeship Committee, approached management with ncern about the implications for the apprenticeship m. Management concurred that conversion might uce a problem and encouraged her to assess the ations for the apprenticeship program. They made ble for study all written information about equip- options.

Apprentice Committee conducted a detailed study mter beginning with a review of available informa- eventually a decision was made by company manage- to purchase equipment from a particular manu- r. The sales representative was requested to provide c information to the Apprenticeship Committee. As growth of their analyses, the Committee determined e only significant change seemed to be in the use of microprocessor to control milling machine operations. result of their investigation, they came up with the ing new work activity: "Must be able to input

judged to be learned on the job, there was no implica- for standards pertaining to related instruction. No o changes in apprenticeship program standards were quired. With this modification, the Apprenticeship C- mittee felt confident that their program was responsive of the state-of-the-art technology demands.

Additional Information

You may also refer to the following related sources:

- D.W. Drewes. *Working for America: A Worker-Centered Approach to Productivity Improvement*. Raleigh, CONSERVA, Inc., September 1982.
- D.W. Drewes. *Vocational Education: Its Role in Productivity Improvement and Technological Innovation*. Raleigh, NC: CONSERVA, Inc., September 1982.
- J.A. Jaffe, E.H. Oglesby and D.W. Drewes, eds. *Technology of the '80s: Their Impact on Trade and Industrial Occupations*. Raleigh, NC: CONSERVA, Inc., September 1982.

Self-Test Exercises

Answer the following problems in the space provided on a separate work paper. Compare your answers with those provided in the Appendix at the back of the booklet.

1. Indicate how you would go about locating new technologies that are likely to change occupational skills requirements.
2. Outline a procedure for assessing the implications of new technology with respect to skills training.
3. Describe a procedure for revising the work activities and associated knowledge to reflect changing skill demands.

Answers To Self-Test Exercises

1. Conduct Occupational Analyses To Determine Need For, Support For And General Content Of The Program

Method	For	Against
Formal employee survey	Comprehensive coverage More accurate results	Time consuming Costly
Informal employer survey	Faster Requires less effort than survey	May be biased Limited coverage
Secondary data from other source	Easy to acquire Data collected by 'experts'	May not be available Data may be outdated May not apply to local conditions

Steps for support building should include:

- Document shortage of craft/trade skill.
- Identify potential sponsors (employers and/or unions) affected by skills shortage.
- Draw up a list of benefits of apprenticeship training.
- Anticipate arguments against apprenticeship training.
- Show potential sponsor(s) that potential benefits from an apprenticeship program can be expected to exceed anticipated costs.

a. <i>Single Employee</i>	Single firm provides major employment opportunities for craft/trade
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- Group of Employees* Skills shortages experienced by multiple employees
- Labor Organization* Union has historically assumed responsibility for craft training
- Combination* Collective bargaining agreement between management and labor

- Form an Analysis Committee
 - Appoint a Chairperson
 - Convene committee
 - Instruct committee as to purpose
 - Identify major work categories
 - For each major work category, define work activities
 - Order work activities according to order of learning
 - Record major work categories and associated work activities ordered according to learning priority.
- h. and e. Both statements refer to required knowledge (familiarity and understanding) rather than actual job behavior.
- You should consider the following elements:
 - Identify and describe types of people required to be dealt with in the course of performing the job.
 - Define the job skills required to deal with the people identified.
 - List the major knowledge areas that are necessary in order to exhibit the job skills defined in b.
 - For each major knowledge area identified in c, provide a more specific description of the knowledge(s) required.

1.1. Establish Goals And Objectives For The Apprenticeship Program

- Describe structure of the program.
- Communicate program procedures.
- Serve as guidelines for program administration.

a. Training Standards

Work Processes

Related Instruction

Safety and Health Training

Terms of Apprenticeship

Probationary Period

Program Evaluation Records

Supervisory Ratio

Administrative Standards

Qualifications for Apprenticeship

Equal Opportunity

Apprenticeship Agreement

Credit for Previous Experience

Wage Schedule

Recognition for Completion

In developing related instruction standards, you should:

- Review the skills-knowledge analysis sheets
- Identify knowledge and understandings that
 - Deal with basic theory and principles
 - Cannot be expected to direct observation and/or on-the-job experience

· Are crucial to job performance but occur infrequently that they are not likely to be learned on the job

- Require charts, graphs, and other supplementary material to assist learning
- Will profit from group discussion and problem solving

c. Assign a number of contact hours considered necessary to master each knowledge and skill

d. Total the number of hours of related instruction and compare with total number of hours allocated to the apprenticeship program.

- Goals are general statements of program intent stated in terms of a target group to be served and a desired outcome for that target group.

Objectives are specific statements as to how the goal will be attained in terms of actions to be taken, measurable results to be achieved and the timeframe allowed.

- Objectives should:

- Be worthwhile and significant
- Be realistically achievable
- Describe appropriate strategies for goal attainment
- Indicate numbers served, performance to be attained or other measurable results
- Be precisely stated to insure understanding.

4. SKILL: Incorporate Ideas That Facilitate Updating of Program To Keep Current With New Technology, New Training Ideas And Changes Occurring In The Program

1. Gather knowledge about technological changes from a variety of sources including:

- a. Trade publications
- b. Manufacturers' representatives
- c. Universities/community colleges
- d. Trade associations
- e. Consultants
- f. Knowledgeable company personnel
- g. Local businesses and industry with similar craft/trade requirements.

2. a. Identify nature of technological change in terms of

- equipment/machines
- operational processes
- materials
- tools
- work setting

- b. For each area of change identified in (a), analyze the impact on job skills with respect to

- operational skills
- repair skills
- problem-solving, diagnostic or troubleshooting skills
- data collection and analysis skills
- people-related skills

- operational procedures
- maintenance procedures
- repair procedures
- troubleshooting procedures
- safety procedures
- materials handling
- basic theory

3. a. For each new knowledge requirement, compare existing work activities and knowledge, select those that come closest to meeting the new requirements;
- b. To the extent possible, modify existing work activities to incorporate new requirements;
- c. For those instances where no similar knowledge existed, add the new knowledge to the apprentice program content.
- d. Determine whether the new knowledge can be gained through on-the-job or related instruction;
- e. If on-the-job, modify the work activities to provide opportunity for mastery of new knowledge;
- f. If the new knowledge is to be gained through related instruction, modify the related instruction accordingly.

ions correctly, you have successfully completed this module. If not, repeat the section(s) of this module with which you have the greatest difficulty.

Which of the following is *not* a direct responsibility of an apprenticeship committee?

- a. Development of selection standards
- b. Assessment of individual apprentice performance
- c. Establishment of training curriculum
- d. Certification of completion

Classification of work activities by major activity areas is termed _____.

The most direct indicator of need for an apprenticeship program is:

- a. shortage of skilled craft/trade workers.
- b. lack of existing training systems.
- c. employer support.
- d. increased applicant interest.

In developing work activities, statements such as "Apprentice must be familiar with . . ." or "Apprentice must be aware of . . ." should be avoided because _____.

The analysis sheets used to analyze an occupation are organized according to three major dimensions. Name the three occupational dimensions.

- a. _____
- b. _____
- c. _____

The purpose of the occupational analysis sheets is to:

- a. identify job skills.
- b. determine equipment needs.
- c. specify worker skills and knowledges
- d. all of the above.

Apprenticeship program goals should contain a clear statement of

- (a) _____ and (b) _____.

Apprentice program standards are useful because they describe (check all that apply)

- a. the content of the program.
- b. expected program results.
- c. the way the program is organized.
- d. the rules governing program operation.
- e. strategies for the attainment of program goals.

Describe the criteria to be used in deciding whether knowledges and skills should be learned on the job.

- a.
- b.
- c.

- c.
11. Identify the three procedural steps for determining the effects of technological change on apprenticeship programs.
- a.
 - b.
 - c.